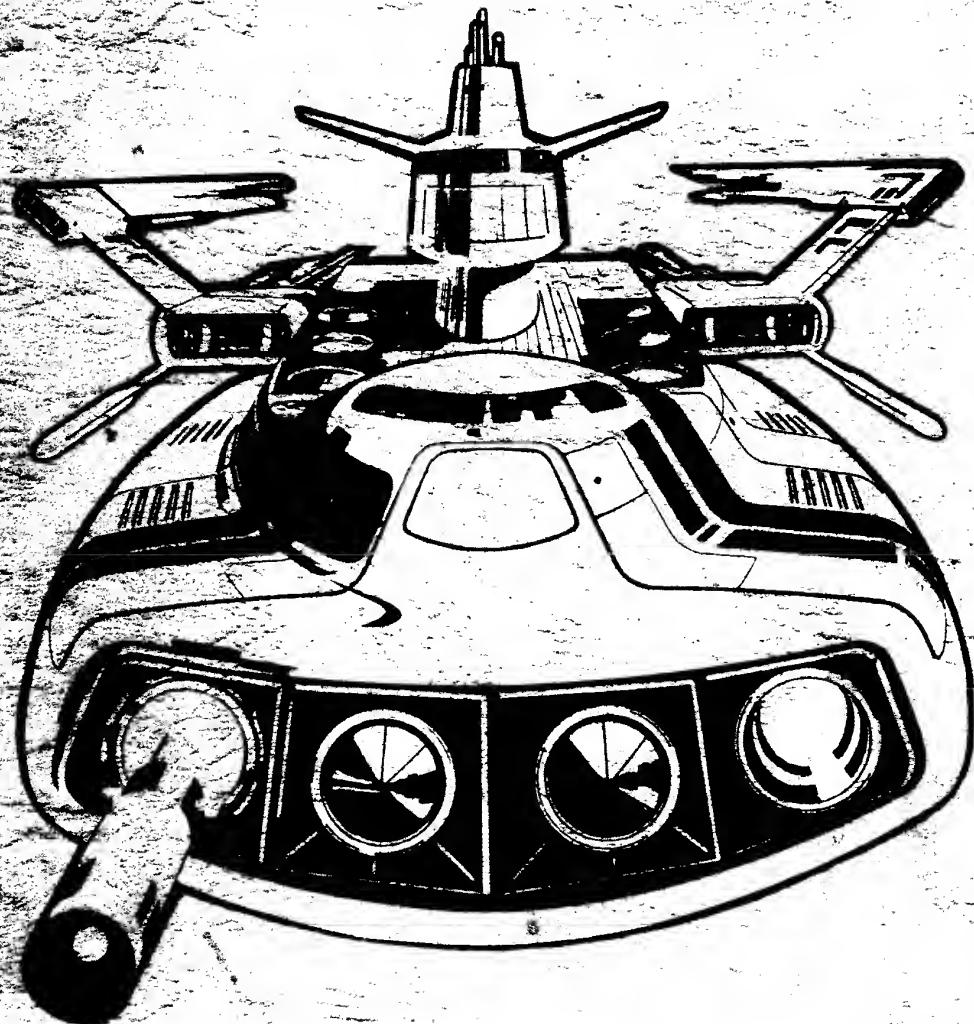


2ND PRINTING - AG

SEGA®
SUBROG-3D™

OWNER'S MANUAL



SEGA ENTERPRISES, LTD.

MANUAL NO. 420-5069

C O N T E N T S

SPECIFICATIONS	1
1 INSTALLATION	2
2 CARE IN OPERATION	2
3 OVERVIEW	3
4 GAME CONCEPT	4 . 5
5 GAME THEORY OF OPERATION	6 ~ 8
6 LOGIC BOARD DIAGRAM	9
7 SELF TEST	10~16
8 DIP SWITCH SETTINGS	17
9 ASSY IC BOARD SUBROC-3D	18
10 TROUBLESHOOTING	19
11 SHUTTER SERVICE (BUTTON TYPE)	20 . 21
12 HOW TO EXCHANGE UP/ DOWN & FIRE BUTTON	22
13 PARTS CATALOG	23~58
14 SCHEMATIC DIAGRAM	59 . 60
15 LOGIC DIAGRAM (CPU . ROM . SOUND)	61~79

SPECIFICATIONS

UPRIGHT TYPE

Dimensions : 67 cm (W) x 86 cm (d) x 195 cm (h)
Weight : 141 kg
Power Source : AC 100-240V
Power Consumption : 160W
Price per Game : Freely Adjustable
CRT : 20" Color Monitor 100V

COCKPIT TYPE

Dimensions : 67cm(w)x156cm(d)x172 cm(h)
Weight : 172kg
Power Source : AC 100-240V
Power Consumption : 160W
Price per Game : Freely Adjustable
CRT : 20" Color Monitor 100V

Note :

1. Details contained herein may be changed without notice, to effect improvements.
2. Supplies of spare parts will be maintained at SEGA Enterprises, Ltd., for a period of five (5) years after the date of manufacture of the game concerned.
3. To enable us to serve our customers more efficiently, we must ask that small orders for spare parts be combined. Minimum orders must be \$50.00 per order.
4. The following note is included in compliance with FCC rules:
WARNING: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 FCC Rules, which are designed to provide reasonable protection against interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

1 INSTALLATION

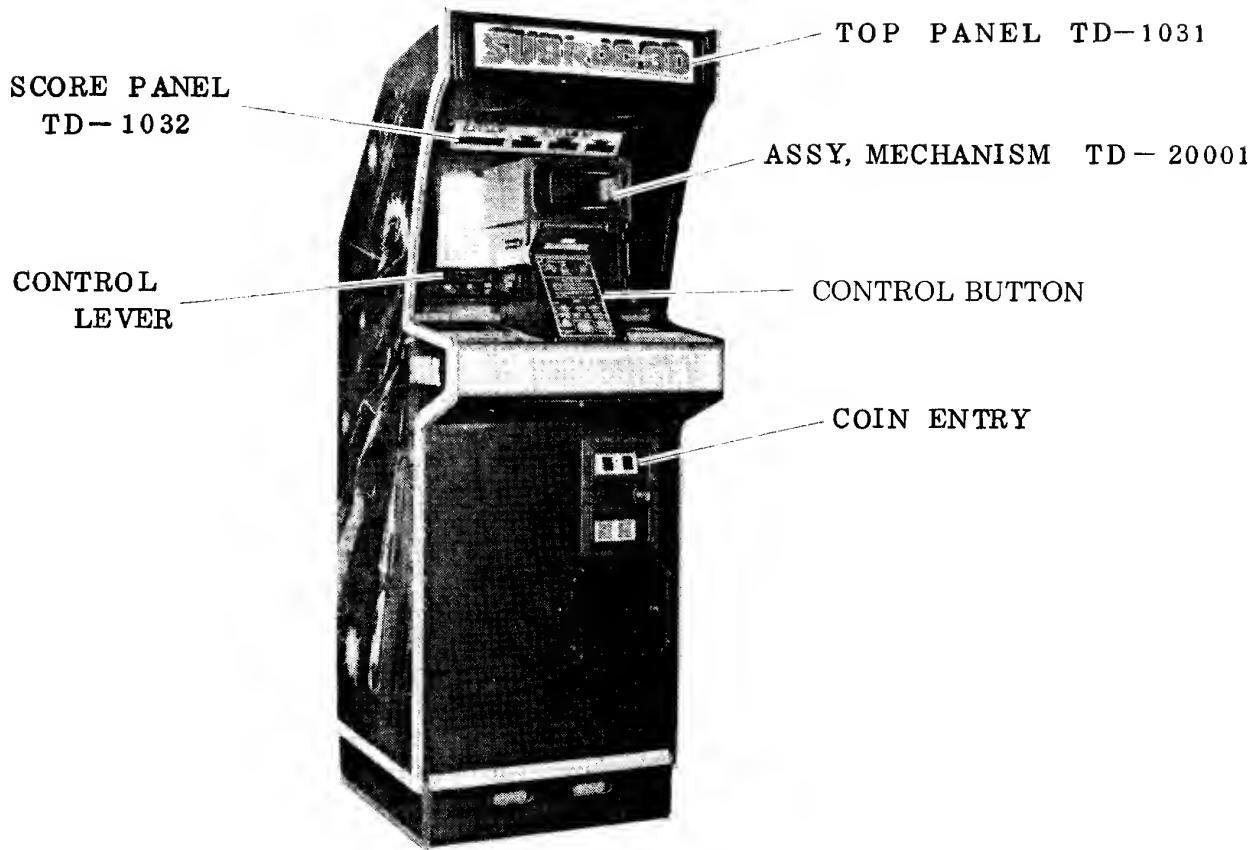
- 1.** As the SEGA SUBROC-3D™ is for "INDOOR USE", do not install it outdoors.
- 2.** When installing it, avoid the following places:
 - Near indoor pools or showers
 - Where leaks exist
 - Under direct sunlight
 - Near heaters or other heat emitting devices
 - Near hazardous items (volatile fluids, gas cylinders etc.)
 - Where vibrations are severe (near construction sites where jack hammers etc. are used)
 - Inclined places
 - Near fire extinguishing equipment
 - Near emergency exits

2 CARE IN OPERATION

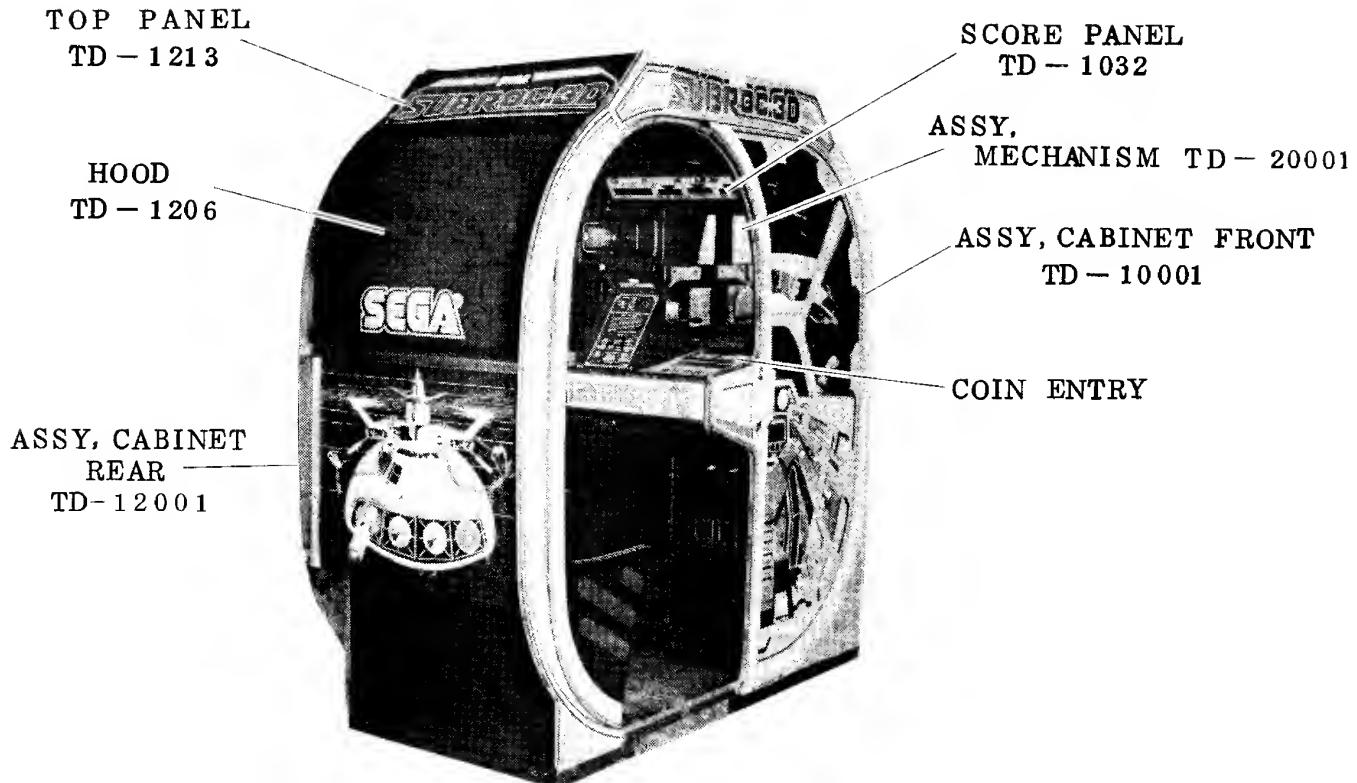
- 1. Inspection**
 - Are the IC boards and other connectors firmly connected ?
 - Connect ground wire as prescribed. (Never connect to gas pipes, water pipes or electrical conduits)
 - Arrange line cords and ground wires in the aisle so they will not be tripped over.
- 2. Care in Handling**
 - Always turn off the power supply switch before handling.
 - Avoid inserting and pulling the plug in rapid succession.
 - Do not check the IC board circuit with a tester.
- 3. Care in Usage**
 - Care should be taken to avoid dragging or dropping the machine when transporting it, to prevent damage to the CRT.
 - Use fuses of stipulated rating.
 - SUBROC-3D™ is a microprocessor based coin-operated electronic game, that makes extensive use of digital integrated circuitry and television monitor concepts. This manual is designed for the use of maintenance technicians who possess a general working knowledge of solid-state circuitry, and video monitor theory. Any individual NOT knowledgeable in these areas SHOULD NOT attempt repair of the electronic portions of the game.
In addition to this manual and training in electronics, troubleshooting and repair will be facilitated by access to general electronic-type handtools, a multimeter, a 50 or 100 Mhz oscilloscope and a logic probe would be helpful.

3 OVERVIEW

UPRIGHT TYPE



COCKPIT TYPE



4 GAME CONCEPT

SUBROC-3D is an overwhelming 3-dimensional game, with a dual scene system for battles in the ocean or in space. The graphics and sound effects are very exciting! You command a sophisticated craft and by using the elevation controls you can move it up or down so it can be operated under water or in space.

The periscope-type viewer can be moved from side to side, enabling you to attack more enemies.

Press the fire button to shoot down the enemy. The dynamic stereo sound system creates an amazingly realistic "surround" effect.

Many strangely-shaped crafts, missiles and UFOs suddenly zoom in to attack you; once they are in your sights they can attack you, so shoot first and survive!

The 3-dimensional effect of fast-moving crafts and missiles, combined with the terrifying explosions seemingly right up close to you are truly bewildering.

To destroy the BARRIER guarding the enemy COMMAND SHIP, you must hit it in the very center.

After blowing up the COMMAND SHIP, you proceed to another round. The bonus points remaining will be added to your score. When you reach "HIGH SCORE" you will get another ship.

In each successive round the score increases by 100 points over the previous round.

Your score and the round are displayed at the top of the screen. Your score and the previous best three scores are displayed over the periscope.

Play ends with the loss of your last ship.

This first-of-its-kind 3-D game, with its speed, excitement and special effects promises to be a really profitable winner from SEGA.

Scoring

Each round 100 points more than in previous round.



300 Points



500 Points



500 Points



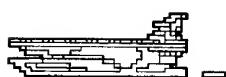
1,000 Points



500 Points



250 Points



Mystery NO. of Points
(1,500~ 2,000 Points)



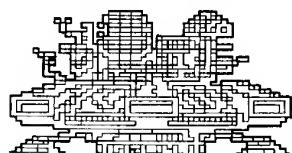
500 Points



500 Points

Mystery NO. of Points
When you explode all
three (1,500~ 2,000 Points)

COMMAND SHIP



3,000 Points

Each round 1,000 points more than previous round.

5 GAME THEORY OF OPERATION

SUBROC-3D™ is a completely new game concept, combining the best of video-game and electro-mechanical principles. It includes all the basic parts of a video game, such as:

1. Power circuits
2. Input ports
3. Memory circuits
4. Output ports
5. A microprocessor
6. A clock and Video timing circuitry
7. Video and Character-generation circuitry

Next is an explanation of where the items listed above are located in the game.

1. Power circuits (page 4/14 and 6/14 of schematics)
The logic boards of SUBROC-3D require + 5 VDC, + 8 VDC, + 12 VDC and -12 VDC. The 8 VDC voltage provides power for the transistors, while 5 VDC powers the coin counter.
2. Input ports (pages D, 3/14 schematics)
The input ports are the means whereby the player communicates with the computer. Refer to the Maintenance Section for more details.
3. Memory circuits (pages D-1/14, 2/14, 4/14, and 7/14 to 14/14)
There are two types of memory devices: EPROMs AND RAMs. The EPROMs hold the program instructions for the microprocessor, and contain character information. The RAMs act as the video memory.
4. Output ports (pages D-3/14, 4/14, and 5/14 schematics)
The output ports are the means whereby the computer responds to the player's actions. The output ports and the associated ICs are listed in the Maintenance Section.

5. Microprocessor (page D-1/14 schematics)

A Z-80A microprocessor is used as the computer heart of SUBROC-3D. It is IC no. 102 on the CPU board. It controls the movement of data and instructions between memory and the outside world.

6. Clock and Video timing circuitry (page D-1/14 schematics)

This clock circuitry consists of a crystal and IC 79. The clock signal drives the microprocessor and the video timing circuits ICs 48, 58, 59 and 68.

7. Video and Character-generation circuitry (pages D-1/14, 2/14, and 4/14 schematics; see also block diagram of logic board)

The color video patterns are produced on the screen by the video RAM (IC 64), the Address Multiplexers (ICs 74, 75 and 76), Video Memory Controller (ICs 48 and 58), Character Generator (ICs 82 and 83) and the Color PROM (RGB outputs).

The address multiplexers are 74LS157 ICs (ICs 74, 75 and 76), located to the left of the IC 64, on the schematic.

These enable the computer or the video timing system to address the RAMs. This switching between computer and video timing addressing keeps updating or refreshing the information in the RAMs. Of course these changes occur so fast that the video image on the screen changes smoothly. The Video Memory Controller ensures that the switching process does not occur at the same time.

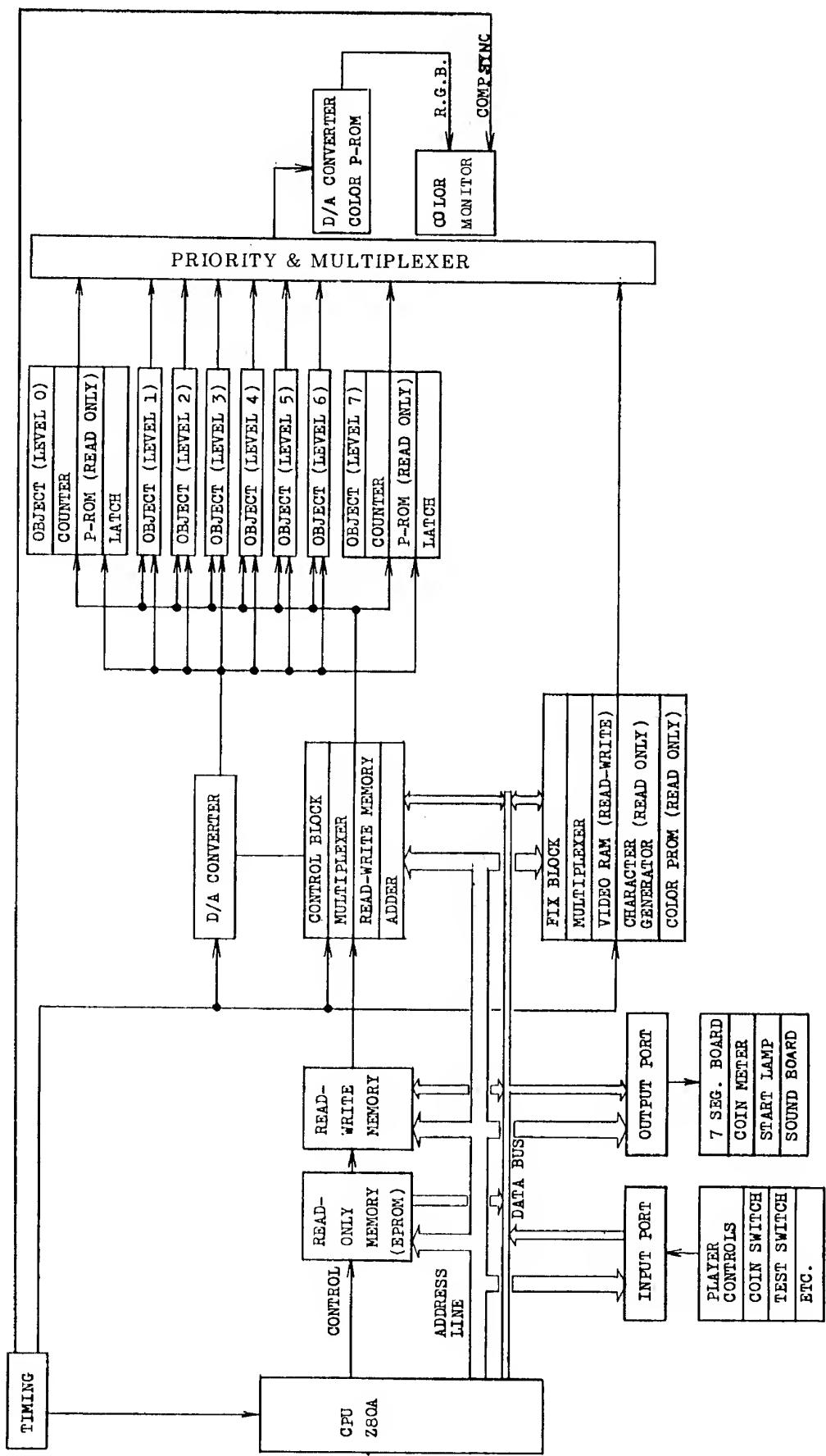
Character generation is handled by a portion of the EPROM which contains the necessary information to produce the various characters of the game. The Color PROM, IC 108, on command from the video memory, generates the pulses which produce the Red, Blue and Green signals for the color monitor.

SHUTTERS FOR 3D

The shutter unit is used to create realistic 3-dimensional pictures. The control of the shutters is such that the left shutter is alternately closed while the right one is open, and vice versa. The integration of the image seen when a shutter is open, the after-image seen when the shutter is closed, and the image seen by the other eye gives a 2-dimensional picture a 3-dimensional effect. Half of the disk-shaped shutter, (which closes off or opens to view for the eye) is painted black. The shutters are driven by a DC motor. The shutter motors and the pictures are synchronized by the signals generated by ICs 115, 116 and 117 on the CPU board.

6

LOGIC BOARD DIAGRAM



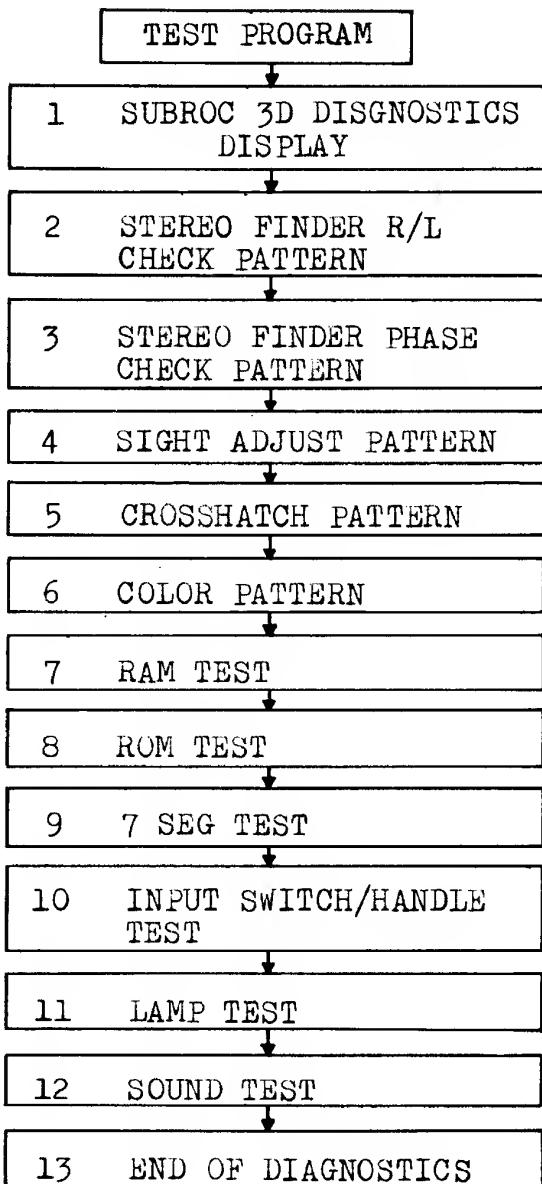
7 SELF TEST

1. General

The main purpose of this test is to check the operation of the game board, to isolate troubles, and for 3-dimensional adjustment of the monitor display.

After checking that each test item is OK by the screen display or sound, press the STEP button (START BUTTON) to advance to the next test item.

2. Test Item Sequence

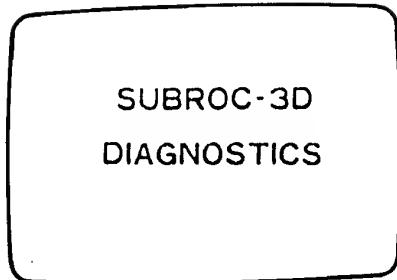


3. Test Items and Contents

Screen display

① Self test start

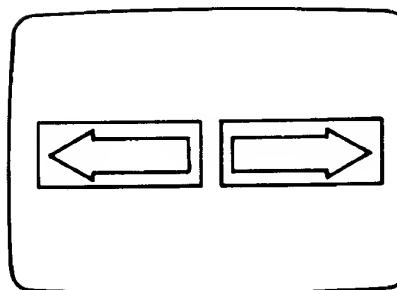
SUBROC 3D DIAGNOSTICS is displayed on the screen.



② STEREO FINDER R/L CHECK PATTERN

Shutter (834-0346) check.

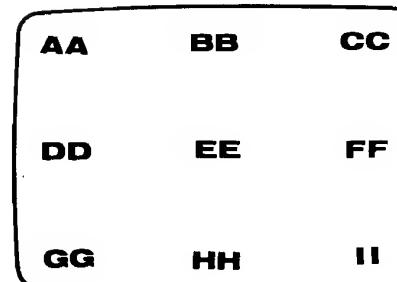
The shutter is operating normally if you can see the left arrow with your left eye and the right arrow with your right eye.



③ STEREO FINDER PHASE CHECK PATTERN

Shutter check.

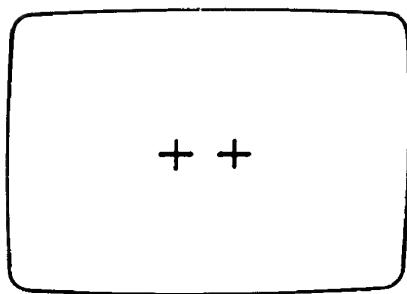
The shutter is operating normally if the two As, Bs, Cs, etc, look like one A, B, C, etc, when you view them with both eyes.



④ SIGHT ADJUST PATTERN

Sight unit (TD-1020 UPRIGHT,
TD-1058 COCKPIT) adjustment.
Two crosses (+ +) are displayed
in the center of the screen.
(Open the back door and turn
the two adjustment screws on the
sight unit by hand so that
the cross on the screen matches
the center of the aim.)

Screen display

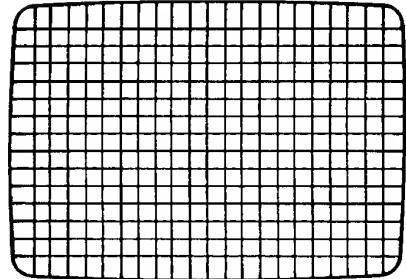


⑤ CROSSHATCH PATTERN

A crosshatch pattern appears on
the screen. Use this pattern for
monitor screen adjustment.

For monitor adjustment, refer to
the Display Manual (420-5028).

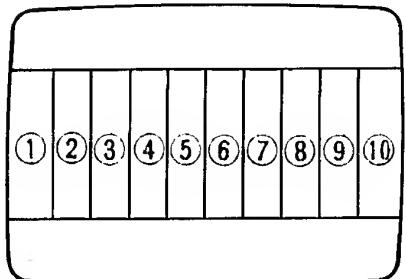
(After this item, the shutter unit
stops operation.)



⑥ COLOR PATTERN

Ten strips of colors appear on the
screen.

- ① Dark blue ② Blue ③ Light blue
- ④ Orange ⑤ Yellow ⑥ Red
- ⑧ White ⑧ Dark gray ⑨ Gray
- ⑩ Magenta



Screen display

(7) RAM TEST

"GOOD" means that RAM is operating normally. When "BAD" is displayed, IC 64 RAM is faulty.

RAM TEST
GOOD

(8) ROM TEST

"GOOD" means that ROM is operating normally.

ROM TEST
EPR 1614 GOOD
EPR 1615 GOOD
EPR 1616 GOOD

(9) 7 SEG TEST

The player's and best 3 scores display segment check.

First, numbers 543210 are displayed.

When the START button is pressed,
each of these numbers changes

000000 → 111111 → ... → 999999.

7 SEG TEST

SCORE	BEST 3
5 4 3 2 1 0	1ST 543210 2ND 543210 3RD 543210

(10) INPUT SWITCH

The ON/OFF state of each switch is displayed on the screen.

INPUTS TEST

LEFT	OFF	DIP 2-1	ON
RIGHT	OFF	2-2	ON
SHOOT	OFF	2-3	ON
START	OFF	2-4	ON
SERVICE	OFF	2-5	ON
COIN 2	OFF	2-6	ON
COIN 1	OFF	2-7	OFF
DOWN	OFF	2-8	ON
UP	OFF	DIP 3-1	ON
		3-2	ON
		3-3	OFF
		3-4	ON
		3-5	OFF
		3-6	OFF
		3-7	OFF
		3-8	OFF

For the setting method , see page 17

(11) LAMP TEST

START button lamp check.

Press the START button repeatedly
and check that it blinks.

LAMP TEST

Screen display

(12) SOUND TEST

12 kinds of sound can be checked here. (Press the SELF TEST button to step to the next sound. To listen to the same sound again, press the START button.)

(1) ENEMY MISSILE

(2) ENEMY TORPEDO

(3) ENEMY FIGHTER

(4) EXPL. IN SKY (explosion in the sky)

(5) EXPL. ON SEA (explosion on the sea)

(6) MISSILE SHOOT

(7) TORPEDO SHOOT

(8) MY SHIP EXPL

(9) PROLOG SOUND

(10) PROLOG OFF

(11) ALARM 0

(12) ALARM 1

SOUND TEST

ENEMY MISSILE

Z 15

X 00

. The value after Z indicates the sound volume. 15 is the minimum and 00 is the maximum.

To change the sound volume, press the SHOOT button.

. The value after X indicates the balance between the right and left speakers.

(00 is the left speaker only and 06 is the right speaker only. Change the value by operating the control lever.)

Screen display

(13) END OF DIAGNOSTICS

The self test ends here. To return to the normal screen, press the SELF TEST button once. To repeat the self test, press the button twice.

END OF DIAGNOSTICS

SEGA ENTERPRISES

Of the above 13 self test items, the shutter motor operates during items

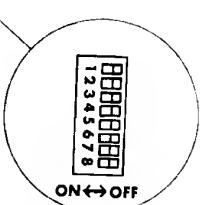
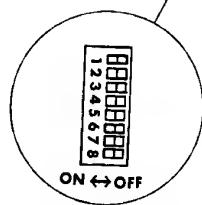
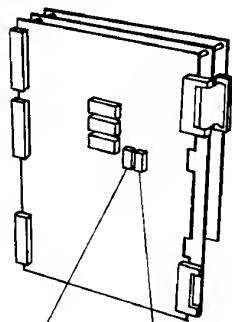
(1) to (4). (The shutter motor does not operate when bit 7 of DIP SW #3 is ON. In this case, only the left arrow is displayed on the screen in item (2).) The shutter motor is stopped during items (5) to (13) (regardless of ON/OFF state of DIP SW #3 bit 7).

8

DIP SWITCH SETTINGS

DIP SWITCH NO. 2

	OPTION	SWITCH SETTINGS ON 8-TOGGLE DIP-SW.							
		1	2	3	4	5	6	7	8
COIN SW. #1	1 COIN 1 CREDIT	ON	ON	ON					
	1 COIN 2 CREDITS	OFF	ON	ON					
	1 COIN 3 CREDITS	ON	OFF	ON					
	1 COIN 6 CREDITS	OFF	OFF	ON					
	2 COINS 1 CREDIT	ON	ON	OFF					
	3 COINS 1 CREDIT	OFF	ON	OFF					
	4 COINS 1 CREDIT	ON	OFF	OFF					
	5 COINS 1 CREDIT	OFF	OFF	OFF					
COIN SW. #2	1 COIN 1 CREDIT			ON	ON	ON			
	1 COIN 2 CREDITS			OFF	ON	ON			
	1 COIN 3 CREDITS			ON	OFF	ON			
	1 COIN 6 CREDITS			OFF	OFF	ON			
	2 COINS 1 CREDIT			ON	ON	OFF			
	3 COINS 1 CREDIT			OFF	ON	OFF			
	4 COINS 1 CREDIT			ON	OFF	OFF			
	5 COINS 1 CREDIT			OFF	OFF	OFF			
PLAYER SHIP	2 SHIPS				ON	ON			
	3 SHIPS				OFF	ON			
	4 SHIPS				ON	OFF			
	5 SHIPS				OFF	OFF			



DIP SWITCH NO. 3

DIP SW NO. 2

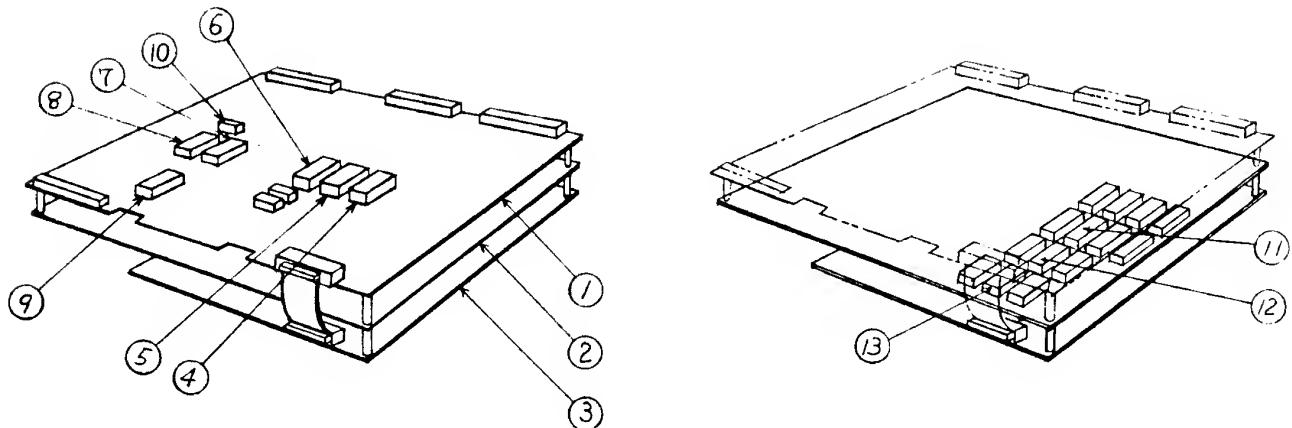
DIP SW NO. 3

OPTION	SWITCH SETTINGS ON 8-TOGGLE DIP-SW.							
	1	2	3	4	5	6	7	8
EXTRA SHIP	20.000PT.	ON	ON					
	40.000PT.	OFF	ON					
SCORE	60.000PT.	ON	OFF					
	80.000PT.	OFF	OFF					
INITIAL INPUT	DISABLE		ON					
	ENABLE		OFF					
DIFFICULTY	DIFFICULT			ON				
	NORMAL			OFF				
FREE PLAY				ON				
NORMAL PLAY				OFF				
STOP MOTION *	NORMAL MOTION				ON			
					OFF			
MONO SCREEN						ON		
STEREO SCREEN						OFF		
ENDLESS GAME							ON	
NORMAL GAME							OFF	

* : Push START button to stop motion.

9

ASSY IC BOARD SUBROC-3D



Description	ASSY IC BOARD		
(1) IC board CPU	834-0357		
(2) IC board PROM	834-0358		
(3) Sound board	834-5058		
(4) EPR-	834-0246		
(5)	1614		
(6)	1615		
(7)	1616		
(8)	1617		
(9)	1618		
(10)	1619		
(11)	1620		
(12)	1666		
(13)	1665		
	1664		

10 TROUBLE SHOOTING ①

When it is believed that trouble has developed, always confirm the following items.

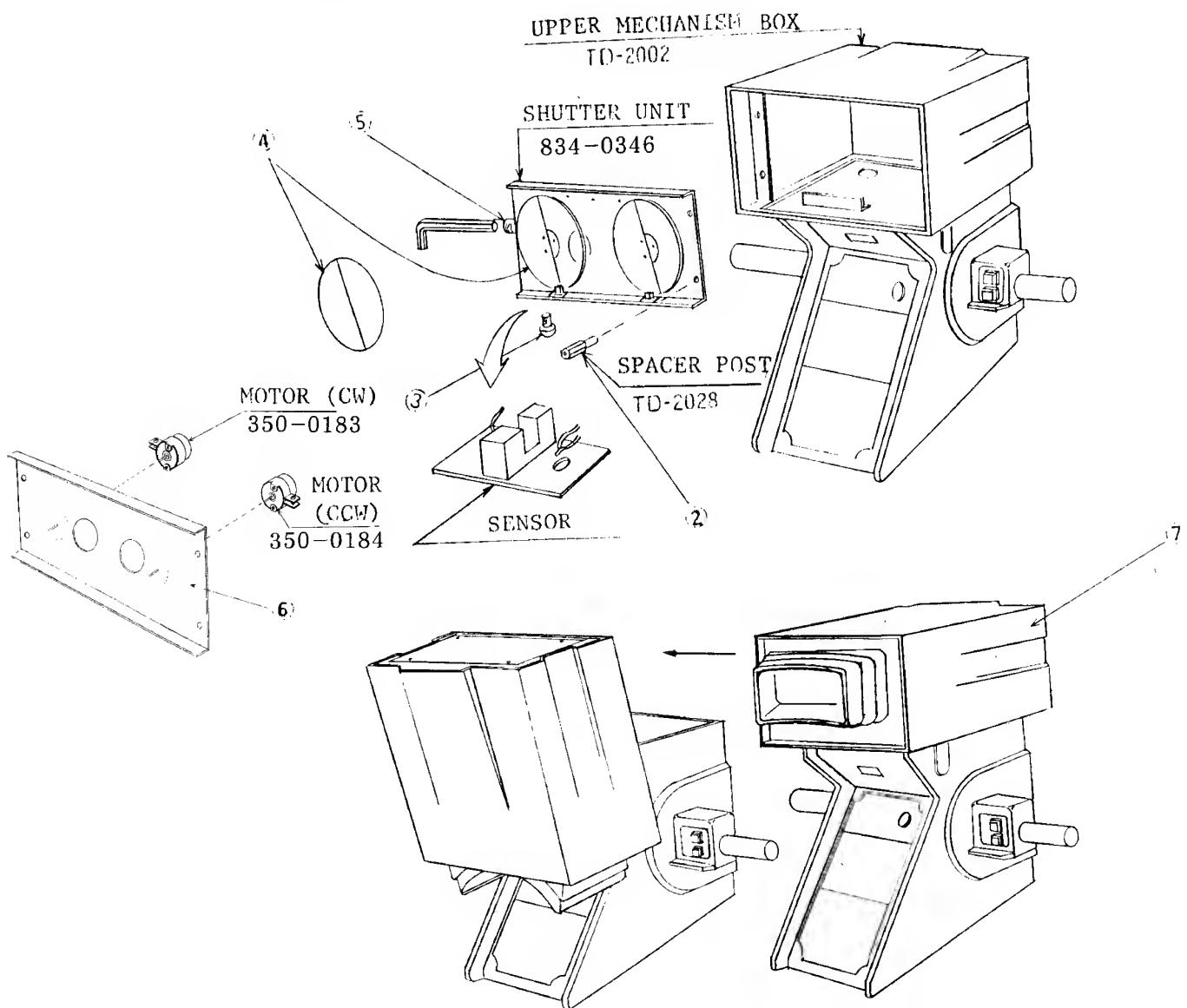
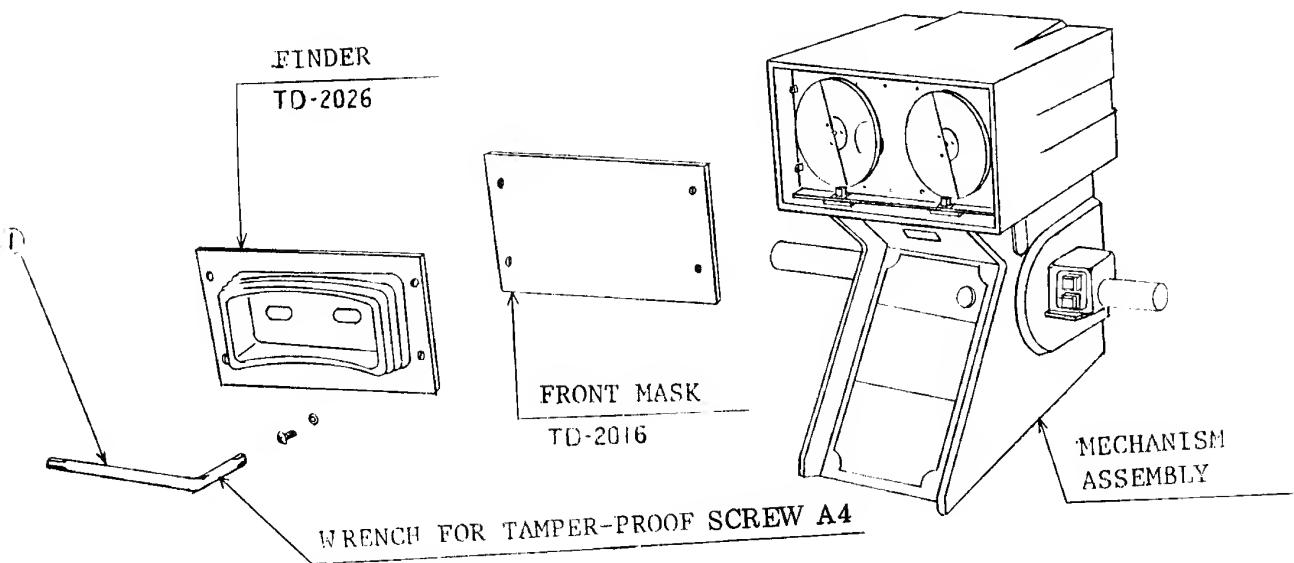
- Is the fuse intact ? (Always use a fuse of the designated rating). If the new fuse burns out , this will indicate that another component is defective.
- Are there any poor connections (connectors) or open circuits. Special care must be taken to ensure connectors are firmly inserted ; trouble due to faulty contacts can be considered from various sources.

Note: Always turn off the power when inserting or removing the connectors.

- There will be times when a normal picture will not appear when the power supply switch is turned on. As this may sometimes be corrected by a setting of the control circuit, turn power supply switch on and off several times.
- When testing meters, switches etc. with a tester, always first pull the IC board connectors.

11

SHUTTER SERVICE (BUTTON TYPE)



SHUTTER SERVICE (BUTTON TYPE)

Time to replace motors

Motors must be replaced if the results as explained cannot be obtained by self tests (1) to (4). Replace the right and left motors at the same time.

How to replace motors

- (1) With the attached wrench for tamper-proof screws, remove the four screws holding the finder TD-2026 and the front mask TD-2016 together.
- (2) Remove the four spacer posts, and take the shutter out of the upper mechanism box.
- (3) Remove the two sensors fixed with two screws each.
- (4) Remove the two discs fixed with three screws each.
- (5) Remove the set screws and the flanges.
- (6) Remove the two screws and replace each motor.

Cautions on reassembly

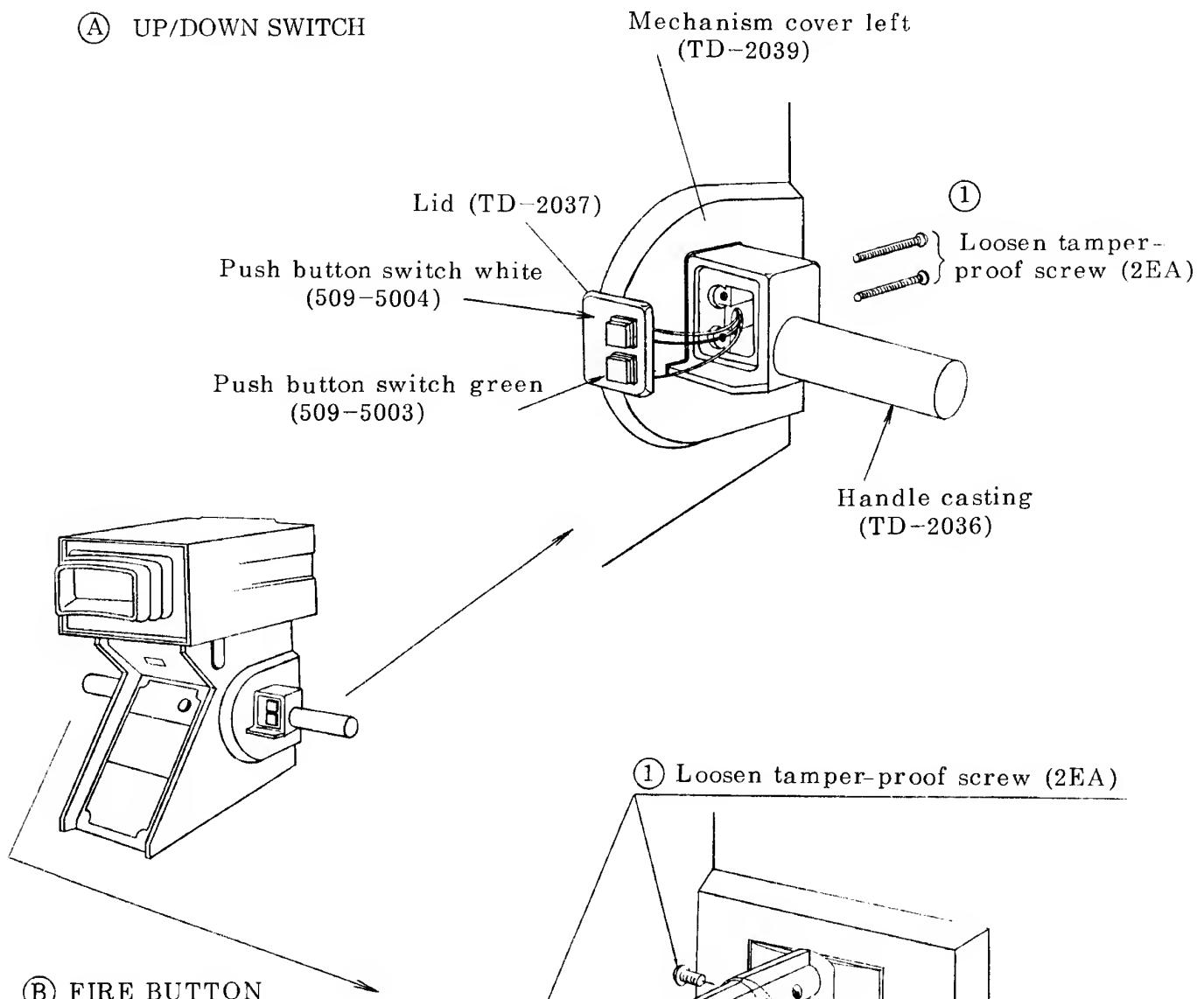
Note that the motor on your left is 350-0183 (CW) and the motor on your right is 350-0184 (CCW) when replacing motors.

When installing the sensors in procedure (3) above, set the sensors so that the discs fit in the center of the concaves of the sensors. The periscope part can be pushed down as shown in (7) in the next figure during reassembly.

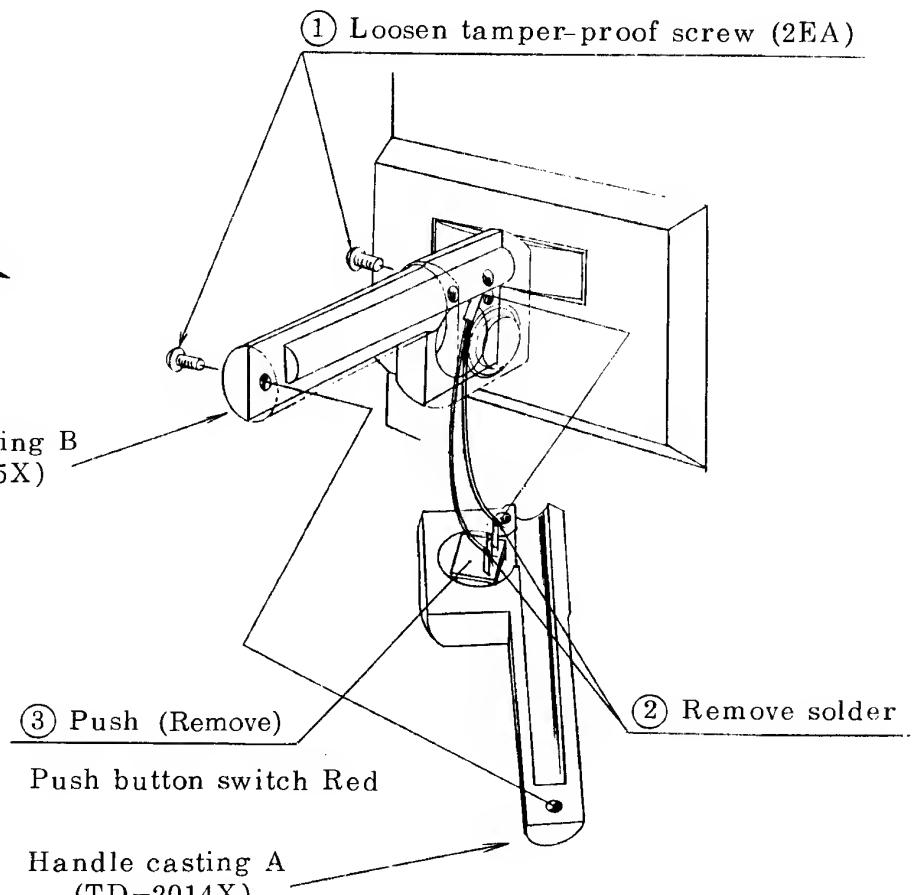
12 HOW TO EXCHANGE UP/DOWN & FIRE BUTTON

With the attached wrench (SGM-3219 Driver or SGM-3152 wrench) for tamper-proof screw (M5), remove the 2 screws holding the casting.

(A) UP/DOWN SWITCH

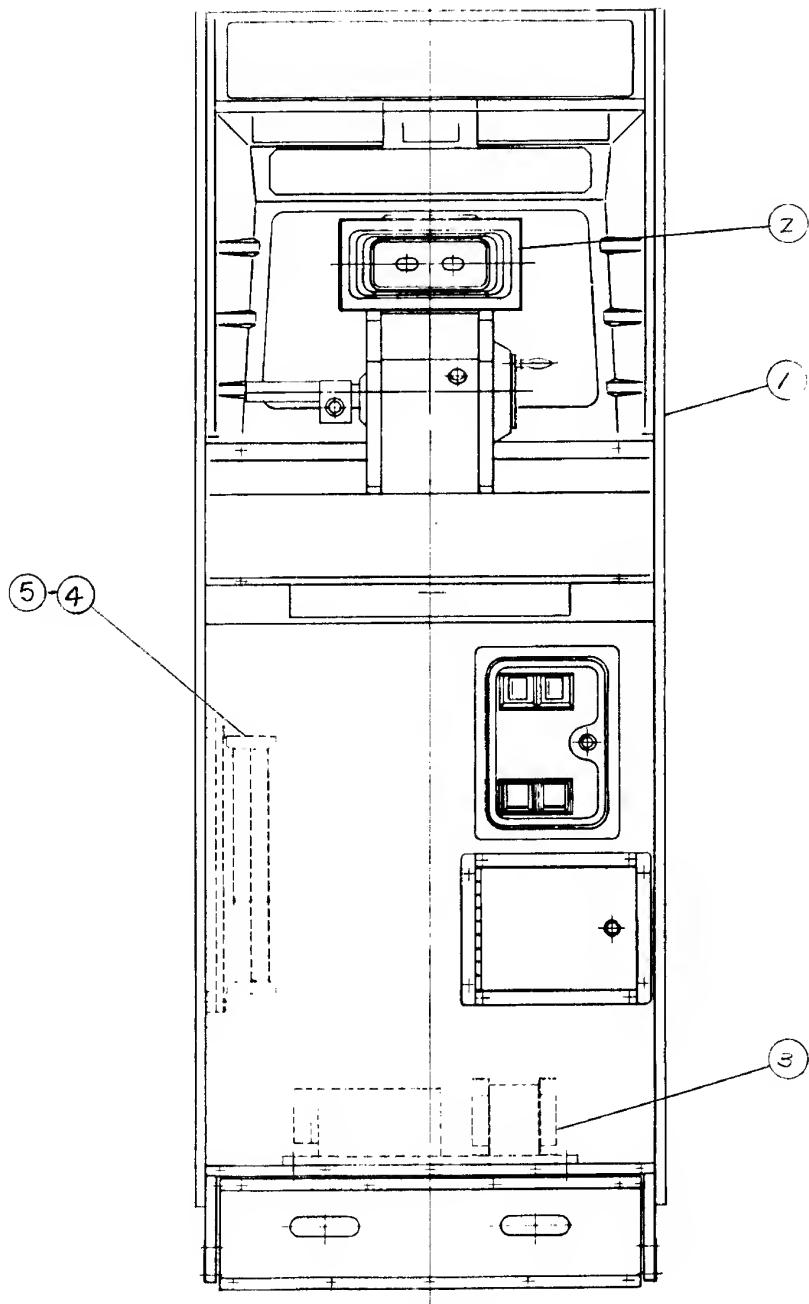


(B) FIRE BUTTON



13 PARTS CATALOG

TOP ASSY UPRIGHT



ITEM NO.	PART NO.	DESCRIPTION
1	TD-1000	ASSY CABINET (See page 24 for details)
2	TD-20001	ASSY MECHANISM (See page 31 for details)
3	TD-4000	ASSY POWER SUPPLY (See page 35 for details)
4	834-0357	ASSY IC BOARD SUBROC-3D EXPORT
	834-0358	Assy IC board SUBROC-3D CPU USA
	834-5058	Assy IC board SUBROC-3D PROM USA
	834-0246	Assy sound board SUBROC-3D
5	834-5060	ASSY EMI FILTER BOARD (See page 43 for details)

UPRIGHT TYPE